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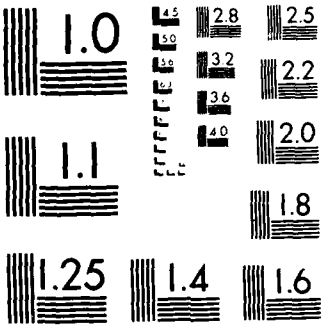

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Techniques of Optical Control of millimeter wave devices have been explored using both mixing techniques and short pico-second optical pulses. The devices under test include the fastest GaAlAs HEMT Structures as well as new high frequency bioplor heterojunction devices.

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Interim Report AFOSR (F-49620-86-K-0007)

Techniques of Optical Control of millimeter wave devices have been explored using both mixing techniques and short pico-second optical pulses. The devices under test include the fastest GaAlAs HEMT structures as well as new high frequency bipolar heterojunction devices.

1) In the case of mixing techniques we are now extending this approach to control devices above 50 GHz. These involve monolithic amplifiers using HEMT technologies. The actual HEMT structures have been tested using six port network analyzers and have demonstrated gain above 100 GHz. Write-ups of these efforts are included for the six port and optical measurements. As part of this work, negative conductivity obtained from the transfer of electrons from the two dimensional electron gas in these layered devices was examined. Reprints of an SPIE paper and an Applied Physics letter are included. More recently we have initiated work on AlInAs/GaInAs "HEMTs" which will be better suited for use with infrared diode lasers used for communications.

2) A substantiated part of our effort is focusing on new types of high frequency heterojunction bipolar transistors specially fabricated for microwave and millimeter wave performance. The electrical measurements in the first devices are included and show useful gain above 30 GHz.

Measurements on this system have been initiated with our pico-second pulse system pumped with a mode locked Argon Ion laser. In order to actually measure the "S" parameters we have designed and are fabricating ultrafast switches as well as electrooptic probes. These are necessary to measure "S" parameters rather than just "gain" in these circuits. It is essential to obtain precise phase measurements if these characterizations are to be useful in device research. We expect to have the measurements made by mixing, pico-second pulses, and by six port electronics fully correlated by the beginning of the summer.

In addition to the papers included I have enclosed two related Ph.D. reports for your files. The two papers from Applied Physics Letters and Physical Review Letters (to be published) represent the successful conclusion of a previous AFOSR supported effort.

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